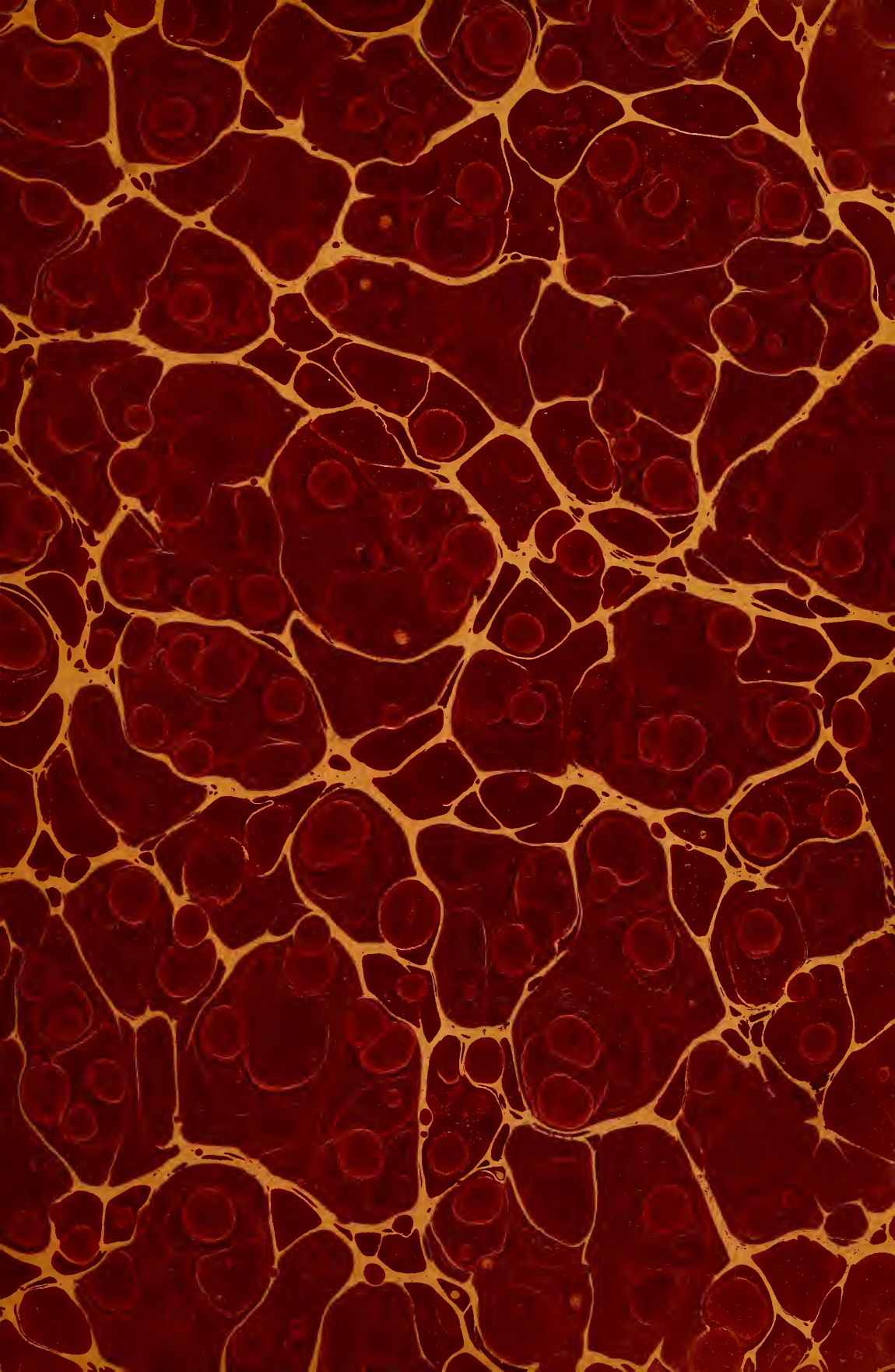




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AMERICAN ECONOMIC ASSOCIATION

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VOL. II. No. 4.

PUBLISHED BI-MONTHLY
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AREA AND POPULATION OF THE UNITED STATES AT THE ELEVENTH CENSUS

BY

WALTER F. WILLCOX, Ph.D.

AUGUST, 1897

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**AREA AND POPULATION OF THE UNITED STATES
AT THE ELEVENTH CENSUS**

PREFACE.

This Study is the first part of a projected Introduction to the Social Statistics of the United States. It will be followed shortly by another on the Density and Distribution of their population. From this standpoint the prefatory chapter should be judged. Both Studies are the outcome of lectures on Social Statistics offered to university undergraduates and are published primarily for their convenience, but may be suggestive to others engaged in teaching or studying the subject. The writer's conception of statistics is that it is a method of giving precision to knowledge by making quantitative and verifiable statements possible in some fields where they have been precluded. The comparative insignificance for social science of the topics which the statistical method frees from the subjectivity of personal opinion or individual observation should not blind one to the important fact that this method contributes to make progress in knowledge possible by liberating certain aspects of it from the labyrinth of personal and unverifiable argument.

WALTER F. WILLCOX.

*Cornell university,
July, 1897.*



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INTRODUCTION TO SOCIAL STATISTICS.

The meaning of the word statistics is still a subject of some dispute. In such a case the ultimate authority is not its etymology, but current usage. This authority is often vague in its utterances, and offers only an uncertain or ambiguous meaning which persons wishing to employ the word with scientific precision, may make more exact, though they may not overrule usage. Judged by this standard, the word statistics refers to the direct or indirect results of counting in the real world about the observer, and no further definite content can be assigned it. The counting may have occurred in any portion of the world. The estimate of the number of stars from enumeration of those in a certain field and multiplication results in statistics. The figures expressing the annual production of iron, lumber or beef, or the average daily attendance at a fair are statistics. Whenever the word is used, the thought is suspended until the subject to which the figures refer is made known. Statistics of *a*, *b*, or *c* is always the rounded notion. Nor is this an error of popular speech, which is avoided by exact writers, for experts give it the same meaning. During the meetings of the International Statistical Institute at Chicago in 1893, papers were offered upon agriculture, railways, education, anthropometry, marriage and divorce and crime, and they were all welcomed as statistical.¹ By the concurrence of popular and scientific usage, then, the word statistics refers to the results obtained in any field of reality by methods of counting.²

¹ Bulletin de L'Institut International de Statistique, Tome VIII, Première Livraison. 1895.

² Rümelin, Reden und Aufsätze, 1875, p. 226.

The word statistics is derived from the same source as state, but the latter has two root meanings, a condition, as the state of one's health, and a political body, as the state of Portugal, and from which of the two statistics is a branch has been disputed.¹ Probably, however, statistics is derived from state in the sense of a political body and the word then means etymologically the science of states. Its history in brief, is as follows:²

Early in the sixteenth century, and partly under the influence of Machiavelli,³ the disinterested study of politics revived. Its practical aspects received in Italian the name of *ragione di stato*, or in barbarous Latin the equivalent *ratio status*. In these phrases *stato* or *status* was the generic name for a political body, while the older and more usual terms, *res publica*, *civitas* and *imperium*, were restricted to specific kinds of political bodies. From *stato* in this sense was formed the Italian *statista*, the German and English *statist*, a statesman,⁴

¹ Some have claimed that both meanings of state were implicate in statistics. This notion apparently finds expression in the definition of Webster, "a collection of facts respecting the condition of the people in a state."

² V. John, *Der Name Statistik*, in *Zeitschrift für Schweizerische Statistik*, 1883; Eng. trans. in *J. Royal Stat. Soc.*, 46: 656-679, (1883). V. John, *Geschichte der Statistik*, pp. 4-11. A. Gabaglio, *Teoria Generale della Statistica*, Vol. 1, p. 59, Vol. 2, p. 1.

³ "We find in him for the first time since Aristotle the pure passionless curiosity of the man of science."—Pollock, *History of the Science of Politics*, p. 42.

⁴ Examples of the early use of *statist* in English, with the meaning of statesman are:

1602: I once did hold it, as our statistis do,

A baseness to write fair and laboured much

How to forget that learning . . . Shakspeare, *Hamlet*, 5:2:33.

and from this the adjective *statisticus*, relating to a statesman. The new studies in practical political science were called *disciplina politico-statistica* or in abbreviated form, *statistics*. That word thus became the name for the studies deemed of especial value to one aspiring to enter the service of a state.

The difference between the present and the original meaning of *statist* and *statistics* is explained by the fact that the latter word was adopted nearly a century ago as the name of a study having a distinct origin, and previously called "political arithmetic." This study of society by the enumerating method had its origin in England, and its inspiration in the triumphs of mathematical and inductive methods gained in other fields by members of the embryonic Royal Society. It began

- 1609 : I do believe
 (Statist though I am none nor like to be)
 That this will prove a war.—Shakspeare, *Cymbeline*, 2 : 4 : 16.
- 1654 : (*written much earlier*) To you the statist of long-flourishing Rome.—Webster, *Appius and Virginia*, 1 : 4
- 1643 : Among statist and lawyers.—Milton, *Doctrine and Discipline of Divorce*.
- 1671 : Statists indeed and lovers of their country.—Milton, *Paradise Regained*, 4 : 354.
- As *statist* in this sense is obsolete the attempt to revive the word as a brief and euphonious substitute for *statistician* seems to deserve encouragement. A few illustrations of this use may be given.
- 1870 : The keen *statist* reckons by tens and hundreds.—Emerson, *Society and Solitude*, (ed. 1876), p. 270.
- 1877 : The high rate of infant mortality continues to occupy the earnest attention of medical statist.—Farr, *Vital Statistics*, p. 190.
- 1895 : How pleased I am to meet again such a body of statist. I like the old and short word.—W. W. Folwell, in *Proceedings of Nat. Ass'n of Officials of Bureaus of Labor Statistics*, p. 54.

with Captain John Graunt, who published his *Natural and Political Observations* in 1662.¹ His conclusions were mainly social rather than physical or biological, and the same is still true of the results obtained by the statistical method. There is, therefore, justification for giving political arithmetic the shorter name derived from the organized political life of man. Popular instinct and language were not entirely at fault. While the enumerating method has never been confined to the study of governmental phenomena, yet it is mainly used for the investigation of some aspect of man's social life. This fact is loosely expressed in both terms, political arithmetic and statistics.

As the applications of the statistical method widen, it seems better to add some modifying word or phrase defining the subject. The work of which this Study is the opening part will be concerned with the applications of the statistical method to man's social life; it is therefore entitled *Social Statistics*. The primary aim, to interest students of society in an unfamiliar method, may be furthered by showing it at work and in connection with its results better than by mere discussion of method. Statements of fact have been incorporated not primarily for their own sake but to elucidate the method. Only the simplest topics under the simplest division, viz., demography or the statistics of population, will be treated, because they best reveal and illustrate it, and in nearly every instance the illustrative facts will be drawn from some portion of the United States.

¹ *Natural and Political Observations* mentioned in a following Index and made upon the Bills of Mortality by John Graunt, Citizen of London. London, 1662.

CHAPTER I.

AREA OF THE UNITED STATES AND ITS DIVISIONS.

Area is usually treated in books on statistics as an unquestionable datum, but the imperfect condition of American surveys makes a brief criticism necessary. Otherwise the trustworthiness of subsequent determinations of the ratio between area and population, *i. e.*, density of population, would be matter of faith rather than of reason. By area is meant the number of units of surface included within certain boundaries, on the assumption that the included surface is all at the level of the sea. In determinations of area the unit of reference is a square degree. Since its area varies with its distance from the equator, the area for each degree of latitude, and so that between the equator and any two adjacent meridians may be requisite as units. From the measurements of a standard authority on the subject¹ the area of the earth's surface, land and water together, is computed as 509,950,778 square kilometers or about 196,899,795 square miles.

The area of any country is the sum of all the square degrees lying entirely within its bounds, and of such parts of the degrees cut by the boundary as lie within the country. The former are found from Bessel's tables or by a geodetic formula; the latter are measured by

¹F. W. Bessel and J. J. Bäyer, *Gradmessung in Ostpreussen*, Berlin, 1838. Compare M. Levasseur in *B. de L'Inst. Int. de Statistique*, 1886, 2ème Livraison, p. 23.

the polar planimeter on accurate maps. The maps of the United States, the theme of this Study, are of varying excellence and no accurate maps of the boundary of Alaska exist. Hence the official statement of its area "may easily be ten per cent. in error."¹ The boundary of the United States between the Lake of the Woods, Minnesota, and lake Superior, and between Schoodic lake, Maine, and the Atlantic ocean is also imperfectly mapped, but the possible error resulting from the uncertain location of these two fragments of our boundary is very slight. The standard measurement of the area of the United States was made by Mr. Henry Gannett and Mr. F. DeY. Carpenter in connection with the Tenth Census.² In defining the boundaries of the country, they excluded the sea within the three mile limit and the portions of the Great Lakes subject to the jurisdiction of the United States, but could state no rule with regard to the treatment of bays or gulfs. While Long Island sound was excluded, Delaware and Chesapeake bays were not. The area of the United States, within the limits thus defined, was measured as 3,025,600 square miles. To this should be added 531,000 square miles as the official estimate of the area of Alaska³ and an undetermined amount as this country's share of the Great Lakes. The latter is estimated by M. Levasseur⁴ as 133,000 square kilometers or about 51,350 square miles, and the total area of the United States excluding the sea within the

¹ Mr. Henry Gannett in a personal letter to the author.

² Tenth Census, Bulletin, The Areas of the United States, Washington, 1881.

³ Eleventh Census, Alaska, p. 11.

⁴ Op. cit., 2ème Livraison, 1887, p. 204.

three mile limit would thus be about 3,607,950 square miles.

Light is thrown upon the territorial position of the United States by a comparison with that of other great powers. The land surface of the globe is stated by various authorities as follows :

AUTHORITY.	Date.	Land surface in		Per cent. of total earth's surface.
		square kilo- meters.	square miles.	
Levasseur ¹	1886	136,100,000	52,160,000	26.5
Ravenstein ²	1890		51,250,800	26.0
Wagner and Supan ³	1891	135,490,765	52,330,000	26.6
Juraschek ⁴	1893	135,454,265	52,300,000	26.6

Probably between twenty-six and twenty-seven per cent. of the earth's surface is land. As inland water surfaces are treated differently by different authorities, the divergencies shown in the table may be due in part to differences in definition of land surface and certainly are due in part to differences of measurement.

A few great powers and many minor powers possess this land surface. The great powers, territorially considered, may be held to include all owning over a million square miles of land. Since their boundaries are fluctuating and ill defined, especially in South America and Africa, any estimate of their areas must be merely approximate. Hence the following table⁵ does not claim

¹ Op. cit., p. 237.

² Statesman's Year-Book, 1892, p. xxv.

³ Petermann's Mittheilungen, Ergänzungsband, xxii, p xi.

⁴ Geographisch-statistische Tabellen, 1893, p. 89.

⁵ Compiled from the Statesman's Year-Book, 1897.

a high degree of accuracy but still it may serve to make clear the relative position of the United States :

TABLE I.

AREA OF COUNTRIES CONTROLLING OVER ONE MILLION SQUARE MILES.

COUNTRY.	Area in square miles.	Per cent. of earth's surface.
British Empire	11,334,391	21.7
Russian Empire	8,660,282	16.5
Chinese Empire	4,218,401	8.1
United States	3,607,950	6.9
Brazil	3,209,878	6.1
France ¹	2,804,839	5.4
Argentine Republic	1,778,195	3.4
Ottoman Empire ¹	1,609,240	3.1
German Empire ¹	1,228,740	2.3
Total	38,451,916	73.5

Among these nine great powers one is purely Asiatic, three purely American, and five inter-continental ; but in their origin seven are European and from present indications the two non-European empires of China and Turkey are tottering. The table thus illustrates both the control of European civilization and governments over the world and the preëminent position territorially of a small number of states. Among these great powers the United States ranks fourth and exercises jurisdiction over between one-fifteenth and one-fourteenth of the earth's land surface.

In the United States exclusive of Alaska, where no such measurements have been completed, there are about 17,200 square miles of coast waters, 14,500 square miles of rivers and 75,250 square miles of lakes.² The Great

¹ Including extensive African possessions.

² Tenth Census, Bulletin, The Areas of the United States, etc., p. 5.

Lakes include over two-thirds of the lake area of the country. As the land surface is 2,970,000 square miles, about $3\frac{1}{2}$ per cent. of the entire area is water. On the average in each ten thousand square miles of total area there are 56 square miles of coast waters, 47 square miles of rivers, and 245, or excluding the Great Lakes, 79 square miles of lakes.

A division conventional and temporary rather than natural, but important for the census, is that between Indian reservations and the rest of the country. Different agencies were employed to count their inhabitants, including the residents of Indian territory and Alaska. In 1890 there were 180,884 square miles of reservations, or 6 per cent. of the area of the country.¹ Their extent, however, is rapidly decreasing. Between 1890 and 1896 they decreased to 130,320 square miles, or nearly 28 per cent.²

The United States, exclusive of purely national territory, namely, the Great Lakes, Delaware, Raritan and lower New York bays, is divided into fifty-one political divisions, of which forty-four at the date of the last census were states.³ The Yellowstone National Park and No Man's Land are apparently included for purposes of measurement within state bounds. Messrs. Gannett and Carpenter have measured the area of each state ex-

¹ Eleventh Census, Indians, p. 91.

² Report of the Commissioner of Indian Affairs, 1896. p. 495.

³ For the sake of brevity the word state or states will be applied henceforth, unless otherwise indicated, to all primary divisions of the country including Alaska, Arizona, Indian, New Mexico, Oklahoma and Utah territories and the District of Columbia.

cept Alaska in the manner already explained¹ and adjusted the results to that obtained for the country. But as their boundaries have been surveyed and mapped less accurately than the national boundary and in certain instances, *e. g.*, between Virginia and West Virginia, are very ill ascertained, the area of a state may be deemed, in nearly every case, less accurate than that of the country. Colorado, Wyoming and Utah, being bounded entirely by parallels or meridians, are exceptions. In the table on page 218, in which the states are arranged in order of size, it will be noticed that the numbers expressing the areas of the states all end in a cipher or a five. Hence they cannot be accurate to a square mile. In a personal letter from which I am permitted to quote, Mr. Gannett says: "The areas cannot be given with such accuracy as to make it worth while

¹*Sources.*—The areas of the United States, of the states and territories, and of the counties and parishes, at the date of the 11th census, are stated in Census Bulletin 23, dated Jan. 21, 1891, and prepared "primarily for the use of the Census Office." The Bulletin gives the gross area, the land surface, and the water surface of the primary divisions of the country, and the land surface of each county and parish, except in the case of Oklahoma. It is apparently the standard authority for the area of the United States, its figures are repeated in standard English and Continental publications, and I am not acquainted with any independent determinations of area for the whole country with which its results may be compared.

The area of each city of over 10,000 inhabitants was asked on the schedule of questions relating to the social statistics of cities, and the areas of fifty of these cities have been published in Census Bulletin 100, Social Statistics of Cities.

The areas of the states of Massachusetts, Rhode Island, Connecticut and New Jersey, and of their counties and towns, townships or boroughs, as they stood about 1890, have been published in recent bulletins of the United States Geological Survey, numbers 115-118.

to give the unit figures exactly excepting in the case of two or three states, and rather than give an incorrect impression of accuracy, I judged it best to round them up to the nearest five or ten square miles."

The water surface of each state except Alaska has been approximately determined under the categories of lakes, rivers and coast waters.¹ From these measurements the proportion of each kind of water surface to the whole area of the state has been computed and is also included in the table on the following page.

On examining the second column two gaps in the series may be noticed between Georgia and Washington and between Maryland and West Virginia. All states above Missouri are larger than the average for the country, which is 69,723 square miles, and Missouri and Washington are larger than the average for the country, exclusive of Alaska. The states then fall into three groups of large, medium and small. All states with more than 60,000 square miles lie west of the Mississippi, and including Alaska cover over nine-tenths of that region. All with less than 15,000 square miles except Vermont touch the Atlantic north of the Potomac. The medium sized states lie between the small and the large. The large states include 68 per cent. of the country's area, the medium states, 30.5 per cent. and the small states about 1.5 per cent. The third column in Table II shows where the largest proportion of lake surface is found. The most extensive lake region is in the vicinity of the Great Lakes. From Minnesota to the Atlantic every

¹ Tenth Census, Bulletin, The Areas of the United States, etc., p. 4.

TABLE II.

GROSS AREA OF THE STATES AND PROPORTION OF COAST WATER,
LAKE AND RIVER SURFACE.

STATES.	Gross area.	Square Miles in 10,000 of area.			
		Lake.	River.	Coast waters.	Total.
Alaska	531,000 ()	?	?	?	?
Texas	265,780	7	30	95	132
California	158,360	100	15	34	149
Montana	146,080	25	28	53
New Mexico	122,580	9	9
Arizona	113,020	2	7	9
Nevada	110,700	84	3	87
Colorado	103,925	1	26	27
Wyoming	97,890	23	9	32
Oregon	96,030	96	52	5	153
Utah	84,970	318	9	327
Idaho	84,800	38	24	62
Minnesota	83,365	456	43	499
Kansas	82,080	46	46
South Dakota	77,650	?	?	103
Nebraska	77,510	5	82	87
North Dakota	70,795	?	?	85
Missouri	69,415	7	92	99
Washington	69,180	52	81	200	333
Georgia	59,475	8	51	25	84
Michigan	58,915	208	44	252
Florida	58,680	384	67	307	858
Illinois	56,650	24	91	115
Wisconsin	56,040	209	75	284
Iowa	56,025	21	73	6	100
Arkansas	53,850	49	100	149
Alabama	52,250	2	84	84	170
North Carolina	52,250	33	48	625	706
New York	49,170	183	61	71	315
Louisiana	48,720	350	111	218	679
Mississippi	46,810	21	73	6	100
Pennsylvania	45,215	7	44	51
Virginia	42,450	6	123	420	549
Tennessee	42,050	24	48	72
Ohio	41,060	39	34	73
Kentucky	40,400	6	93	99
Oklahoma	39,030	?	?	51
Indiana	36,350	30	91	121
Maine	33,040	697	91	165	943
Indian territory	31,400	?	?	127
South Carolina	30,570	2	59	71	133
West Virginia	24,780	55	55
Maryland	12,210	410	1515	1925
Vermont	9,565	398	52	450
New Hampshire	9,305	237	86	86	409
Massachusetts	8,315	108	72	151	331
New Jersey	7,815	45	154	262	461
Connecticut	4,990	80	160	50	290
Delaware	2,050	291	146	437
Rhode Island	1,250	160	80	1080	1320
District of Columbia	70	1429	1429
United States ¹	3,076,950	245	47	56	348

¹ Excluding Alaska and the sea within the three mile limit but including Delaware, Raritan and lower New York bays and this country's portion of the Great Lakes.

state on the northern boundary of the country except Ohio, and every New England state except Connecticut, has over one per cent. of its area in lakes. The same is true of Florida, Louisiana, California and Utah. From the fourth column it appears that the largest proportion of river surface is found along the Atlantic coast in Connecticut, New Jersey, Delaware, Maryland and Virginia, and also in the lower Mississippi valley, in Arkansas and Louisiana, each of these states having over one per cent. of river surface.

The states which had over five per cent. of their area in Indian reservations in 1890 were :

States.	Per cent. of area in Indian reservations.
Indian territory	100
Oklahoma	48
South Dakota	47
New Mexico	13
Montana	11
Washington	9
Minnesota	9
Arizona	9
Utah	8
North Dakota	7
Idaho	5

It will be seen that they lie mainly west of the Mississippi along the northern and southern boundaries of the country.

In the census volumes¹ the fifty states of the Union excluding Alaska are divided into five geographical

¹ See for example the Abstract of the Eleventh Census, second edition, p. 10. The student should have this excellent hand-book at his side. References will be made to it, rather than to the large volumes, wherever possible.

groups, the north Atlantic, south Atlantic, north central, south central and western. The primary line of division is perhaps that between the Rocky Mountain and Pacific Coast states and those lying east of the great plateau. It follows the meridian of 104 degrees west, *i. e.*, the western boundary of the Dakotas, or the state boundary nearest thereto. It also coincides roughly with the line of 5,000 feet of altitude. Only a trifling part of the area to the east of it rises above that elevation, while fully half of the land to the west is more than that height above the sea level.

The states east of this line are divided upon geographic, historic and economic grounds into north and south. The division is made by a line coinciding in the main with that separating the former slave states from the free states. It follows Mason and Dixon's line, the Ohio river, and the parallel of 36 degrees 30 minutes, or the state line nearest to that, until it intersects the division line between the central and western states. Missouri is thus classed with the north and Oklahoma with the south. Each of the southern states as thus defined, except West Virginia and Oklahoma, has over ten per cent. of negroes in its population, while this is true of no northern state.

The last division, that between the Atlantic and the central states, follows as nearly as the state lines allow the height of land separating the two drainage areas but is invariably somewhat to the west of this natural division. West Virginia is the only exception. While most of the state sends its rainfall to the Ohio river it

is classed for historic reasons among the Atlantic states, and while it has a smaller proportion of negroes than any other southern state, or than Missouri of the northern, it is classed for the same reason among the southern states.

With the exception of the District of Columbia and Alaska, each of the fifty-one primary divisions of the country is subdivided territorially. In 1890 there were about twenty-eight hundred (2790) of these subdivisions, or counties as they are almost uniformly called. This includes the District of Columbia, the parishes of Louisiana, the six reservations of Indian territory, and two parcels of unorganized territory about the size of counties, one in North Dakota and one in Nebraska. For the sake of brevity all these secondary divisions will henceforward be called counties. The average size of a county in the United States is rather more than one thousand (1085) square miles and the range is from Bristol county, Rhode Island, with only twenty-five square miles to Yavapai county, Arizona, over one thousand times as large (29,236 square miles). It is not generally true, however, that the smallest states have the smallest counties. On the contrary the smallest counties occur as a rule in the border states east of the Mississippi river where their average size is less than five hundred square miles, as a little computation will readily convince the reader.

The areas of the country and of the states published in connection with the census of 1880 were not changed for the census of 1890. But the areas of the counties

were "thoroughly revised"¹ involving a correction on the average of perhaps five per cent., a part of which may have been due to changes during the decade in the location of county boundaries, but more to increased accuracy of measurement. The method of measurement resembled that employed for the country and the states: that is, the area of each state was the starting point and the county areas, determined primarily by the polar planimeter, were corrected by a reference to the requisite total; but as the mapping of county lines is generally less accurate than that of state boundaries, the probable error in county areas is greater. Mr. Gannett writes me: "Excepting where we have accurate maps of county boundaries, the areas given can be regarded only as very rough approximations and this is true in all the eastern states and especially so in those of the south where the location of county boundaries is not represented alike upon any two maps."

In Rhode Island, where the Geological Survey also has determined the land surface of the counties, the results of the two are comparable, and show an average variation of six per cent.² The results of the Geological Survey in New Jersey were the basis of the census figures, and in Massachusetts and Connecticut the former gives the gross area, not the land surface. If both were accurate in the latter states, the Geological Survey figures would form a maximum limit not exceeded in any

¹ Eleventh Census, Bulletin 23, p. 1. Compare Tenth Census, Bulletin, The Areas of the U. S., etc.

² The land surface of the counties of Rhode Island is given as follows in the two authorities:

case by those of the census. In fact the land surface of eight of the twenty-two counties is stated by the census bulletin as greater than their gross area indicated by the Geological Survey, a proof of not a little inaccuracy in one or the other.¹

Such discrepancies have made it seem worth while to attempt a determination of the probable error in the official census statement of county areas. The simplest method to follow would be a repetition of planimetric measurements on our most accurate county maps, the United States post route maps. This method has already been employed by a German critic and the results in three cases published,² but it is obviously open to the objection that in those maps the county lines may have been inaccurately drawn. Far more accurate than those are the maps of the United States Coast and Geodetic Survey and of the United States Lake Survey, but these latter represent only natural not political divisions and

COUNTIES.	Geological Survey Bulletin.	Census Bulletin 23.	Per cent. of variation.
Bristol	25	25	0
Kent	169	180	7
Newport	117	100	15
Providence	411	440	7
Washington	331	340	3
Total	1,053	1,085	

¹ For example the Survey bulletin gives the gross area of Berkshire county, Mass., as 942 and of Norfolk county, Mass., as 433 square miles, while the census gives the land surface alone of the same counties as 959 and 494 square miles.

² Cf. Petermann's *Geographische Mittheilungen*, *Ergänzungsbände* 17-18, No. 84, p. 4, footnote.

include only our boundary districts. There are, however, six cases in which natural divisions between land and water coincide with county lines ; in other words along the boundary of the United States there are six islands or groups of islands which are also counties. They are Nantucket, Martha's Vineyard, Long island, Staten island, Isle Royale and Beaver, Fox and Manitou islands. Long island is divided into three counties, and is the only island containing more than one. The areas of these counties on the Coast Survey or Lake Survey charts have been twice measured carefully by Mr. J. F. Hayford, C.E., formerly of the United States Coast Survey and now of Cornell university, and from his results I have prepared the following table :

TABLE III.

COMPARISON OF MEASURED LAND SURFACE OF CERTAIN COUNTIES IN SQUARE MILES WITH CENSUS FIGURES.

COUNTY AND STATE.	ISLAND OR GROUP.	Measured area.	Area by Census Bulletin, 1880.	Area by Census Bulletin, 1890.	Area by other authorities.	Per Cent. of variation of census 1890 area from measurement.
Dukes, Mass.	Martha's Vineyard.	103.4	120	124	110*	20
Nantucket, " Kings, Queens and Suffolk, New York .	Nantucket .	49.7	60	65	51*	31
Richmond, New York.	Long island .	1353.8	1110	1007	1682†	25
Manitou, Mich.	Staten island.	55.7	60	61	59†	10
Isle Royale, Mich.	Beaver, Fox and Manitou	109.3	200	120	10
	Isle Royale .	203.7	230	215	5

* U. S. Geological Survey, Bulletin 116.

† New York Census of 1875, p. 264.

If these instances were typical, the county areas in Census Bulletin 23 were in error by an average amount of 17 per cent. But the north central and western states are probably better mapped and measured than these results would indicate. It should also be remarked that in four of the six cases the changes made in 1890 resulted in greater inaccuracy than before. It has surprised me to find that the area of Long island, perhaps the largest and certainly the most important island in the country, has not been determined to within twenty-five per cent. The latest Federal authority, as appears from the preceding table, gives it as 1007 square miles, while what is I believe the latest state authority, the state census of 1875, basing itself directly upon Hough's Gazetteer and ultimately upon French's Gazetteer of 1860, gives its area as 1682 square miles. The latter is the authority followed by such good secondary sources as the last editions of the Encyclopædia Britannica and Johnson's Cyclopædia. It will be seen that the state and Federal authorities differ by over six hundred and fifty square miles and that each is over three hundred miles wide of the truth as first established by Mr. Hayford's measurements.¹

¹ To illustrate the care with which his work has been done I append his report to me on the measurement of the area of Long island. The map from which his measurements were made was the Coast and Geodetic Survey Chart, No. 52, "Montauk Point to New York." It will be seen that his two determinations differ by less than a fourth of one per cent. He is confident that the errors of measurement as distinguished from the errors of the map are well within one per cent.

LINCOLN HALL, April 29, 1896.

Prof. W. F. Willcox :

DEAR SIR—By the use of the polar planimeter on the C. & G. S.

The census makes no general effort to determine the area of divisions smaller than counties, except in the case of large cities. The areas of fifty of these are stated in one of the bulletins and assurance is given that they "have been either determined by actual measurements from latest obtainable maps or from records in offices of the several city engineers."¹ The areas of nearly all the cities and towns of Massachusetts, Rhode Island, Connecticut and New Jersey are given in recent bulletins of the United States Geological Survey. Eleven of the fifty cities included in Census Bulletin 100 are in these four states and six other cities are co-extensive with counties of the same name. Hence for one-third of the fifty cities there are two independent and comparable determinations of area. The general result

map which you furnished, I have obtained the following results. Long island was for convenience divided into seven sections, arbitrarily, and the area of each section measured twice.

No. of Section.	Sq. stat. miles 1st measurement.	Sq. stat. miles 2d measurement.
1	129.6	127.2
2	246.6	246.1
3	334.1	335.2
4	9.0	9.9
5	287.1	286.4
6	253.9	256.2
7	95.1	91.2
Total area	1355.4	1352.2

Mean of two measurements = 1353.8 sq. miles.

The method used eliminates the effect of the shrinkage of the paper on which the map was printed,—each portion of the area being compared with the area of the circumscribing rectangle formed by printed meridians and parallels.

Yours respectfully,

JOHN F. HAYFORD.

¹ Eleventh Census, Bulletin 100, p. 5.

of a comparison is to reveal occasional discrepancies too wide to be due to variations of measurement; *e. g.*, St. Louis 48 and 61 square miles, San Francisco 50 and 15, New Orleans 187 and 37, Holyoke 4 and 18. An explanation is found in the fact that for the bulletin on the Social Statistics of Cities only the built up area of certain cities was measured. This fact is not stated in the bulletin itself but has been authoritatively admitted to me in correspondence. As there is no way to decide for what cities it is true, it is impossible to accept the careful measurements in that bulletin since we can not tell what area was measured. Still it may be mentioned that among the populous cities of the country there are apparently only two of great area, Chicago and Philadelphia. They are said to include respectively 161 and 129 square miles, while the third in size, St. Louis, contains only 61, and New York only 40 square miles.

The preceding analysis points to the conclusion that owing primarily to the inaccurate or incomplete surveys upon which reliance must often be placed, the determinations of area of the United States, and of its political divisions large and small, are not to be accepted without hesitation. It may serve also as an example of a kind of interpretative criticism which, although perhaps impracticable under past conditions, would be extremely desirable from the compilers and editors of our official statistics. They could prepare it more easily and accurately than a private individual unfamiliar with the processes by which statistical results have been secured. Notwithstanding these reasons for

its inclusion, so detailed a criticism of what is merely preliminary to the study of social statistics would hardly be in place, were it not hoped that it would conduce to awaken in the beginner an attitude of independent inquiry and a refusal to accept on authority any fact which may be made for him to rest on a better foundation. Such an attitude is an indispensable prerequisite to the successful study of statistics and one difficult to establish in an untrained mind.

CHAPTER II.

POPULATION OF THE UNITED STATES AND ITS DIVISIONS.

The word population means the number of living human beings. Yet along with this, its usual present meaning, there occurs a secondary one of importance in the history of political economy and statistics, viz., increase in the number of human beings. While the classical writers on political economy use the word in both senses or equivocally, in the title and pages of Malthus's *Principle of Population*, and in the discussions it has aroused, emphasis is laid upon the idea of increase. Light is thrown upon this double meaning by the history of the word. While Bacon employed it in substantially its present meaning, it seems not to have become current in the European languages until the last century, and then often if not usually with the active sense of increase more or less clearly marked.¹ This meaning of population, like the original meaning of statistics, is now of importance only to the historian or the critic.

¹ Its use in this active sense during the latter half of the last century may be illustrated by the following quotations from German, French, English and American sources :

- 1761 : Suessmilch, The population (*Bevölkerung*) of a state as a duty of its ruler.
- 1772 : Raynal, The surest proof of the population (*population*) of the human species is the depopulation of other species.
- 1776 : Declaration of Independence, He has endeavored to prevent the population of these states.
- 1798 : Malthus, Rapid population.

As the number of human beings is variable in time, increasing with births and decreasing with deaths, the concept must be limited by a reference to some definite point or period of time. By the last census of the United States the time was fixed as the first day of June, 1890. All inhabitants living on that day and no others were enumerated. Concerning the manner in which the several thousand persons born or dying on that day were to be entered no instructions were given to the enumerators. The foreign practice is to make a census speak as of a certain moment, commonly midnight, of the enumeration day, and the practice is theoretically preferable to our own. The concept must be limited also in space to a certain country or part of a country. In the case of area the whole is known better than its parts, and is the standard by reference to which the parts are corrected; in the present subject the primary datum is the population of the parts from which that of the whole is laboriously and imperfectly constructed. But in defining population with reference to any part of the earth's surface, difficulties at once arise from the mobility of human beings.

The population of a country having a census is merely the sum of the populations of the districts into which it is divided for enumeration and each of these in the United States is supposed ordinarily to contain about four thousand inhabitants.¹ Hence the basal definition is that of the population not of a country,

¹ "The subdivision assigned to any enumerator shall not exceed four thousand inhabitants as near as may be, according to estimates based on the Tenth Census." Census Law of March 1, 1889, § 12.

state, county or city, but of an enumeration district. By what criterion shall an enumerator on his round decide whether any person he meets belongs to the population of his district? The International Statistical Congress at St. Petersburg in 1872, in voting that general censuses of population should include all persons present in the enumerator's district at the moment to which the census relates, offered an answer to the question, which has the advantage of furnishing the enumerator with a simple test question, "Were you in my district, *i. e.*, within certain known boundaries, at a certain recent moment?" This is now the method almost universally followed in Europe. But where it is employed the census must be taken with great speed, the common European practice being to complete the primary enumeration within twenty-four hours, and it is doubtful whether such expedition would be practicable under American conditions. At present the field work in the national census may by law occupy two weeks in a city of over ten thousand people and a month elsewhere,¹ and in practice does not fall much within that.

While under the terms of the constitution of the United States² the census is to include "the whole number of persons in each state excluding Indians not taxed," Congress has uniformly interpreted the word "numbers," or the phrase, "persons in each state," to mean the inhabitants rather than the persons physically present in each district, and the states have followed the same prac-

¹ *Ibid.*, § 19.

² Amendments, Article xiv, § 2. Compare Constitution, Art. 1, § 2.

tice. Each enumerator, accordingly, must take oath that he will count all the inhabitants of his district,¹ and the implied test of inhabitancy is having one's "usual place of abode"² in the district. In explanation of this ambiguous phrase the Instructions to Enumerators at the last census says: "It is difficult to afford administrative directions which will wholly obviate the danger that some persons will be reported in two places and others not reported at all. Much must be left to the judgment of the enumerator," (p. 21). As the latter may wish to show that his district or city compares favorably with that of others and as his pay depends upon the number of names secured rather than on the hours worked,³ he may be expected to include on his schedules most of the doubtful cases which come to his knowledge. This consideration raises the large and difficult problem of the accuracy of the census of 1890.

This Study is based upon the Eleventh Census and yet, as already shown in the previous chapter, the entire trustworthiness of that basis cannot be assumed. Neither can it be proved at the outset. On the contrary it must be accepted as a working hypothesis to be constantly tested and if necessary corrected or rejected as the results of investigation require. The ability to probe a census and to form an independent and reasoned judgment upon its accuracy is perhaps as high evidence as can be given that one has served his apprenticeship to the statistical

¹ Census Law, § 8.

² *Ibid.*, § 9.

³ *Ibid.*, § 11.

method and mastered it. Hence at the start only a few general suggestions are in place.

A census is not a unit or an organic whole, but a collection and interpretation of the answers to a long series of questions set all over a country and to all classes of society. The answers vary in accuracy with the region and social class from which they come, and with the character of the question asked. Answers from Massachusetts or Rhode Island, where regular and careful state censuses contribute to maintain a statistical tradition among the people, are more trustworthy than answers from New Mexico. Answers from whites are probably more correct than answers from negroes. A citizen will give the place of his birth more correctly on the average than the information whether he is a pauper or a sufferer from chronic disease. Hence finding the accuracy of a census is not a single or simple problem, but can result only from finding the accuracy with which each question was answered and balancing the results. Rarely if ever is a census so ill taken that no conclusions are to be derived from a critical use of its figures; rarely if ever is one so well taken that all it contains may be accepted without criticism and at its face value.

But the number of people in a country is the primary fact derived from a census and therefore to dispute a census is commonly and naturally understood to apply to that alone. After the trustworthiness of this result has been investigated, however, that of every other return on which inference or argument is based should be made,

if possible, the theme of a separate study, a requisite not infrequently ignored, but one on which unfortunate experience leads me to insist.

Errors may creep into a census through blunders of the public, of the enumerators, or of the central office. Blunders of the public are either ignorant or wilful. Of the persons visited some are unable to answer the questions put to them. Many would not know their "age at nearest birthday". Many who would be offended by doubt of their ability to answer so plain a question would give their age at the last birthday; of such replies about half must be wrong. Unwillingness to answer is a more serious cause of error than inability. Many persons born abroad, would return themselves as native. Some would be unwilling to admit service in the Confederate army, others the mixture of negro blood, others that they were divorced, others inability to read or write. But perhaps the questions which at the Eleventh Census aroused most widespread dissatisfaction, and were probably answered with least correctness, were those in reference to acute or chronic diseases, bodily or mental defects, delinquency or dependency. The accuracy of answers to these questions must be established or the results treated as giving merely a minimum. To demand such information tends to arouse in the public mind an antagonism to the entire work which may seriously impair the accuracy of other answers, for its success depends largely upon a public coöperation that is easily forfeited. An active desire to mislead occasionally appears on a large scale, especially in the case of

rival cities, in deliberate exaggeration of the number of people. Conspicuous instances at the last census were those of Minneapolis and to a less degree St. Paul; in each a recount was ordered. In these instances the enumerators divided the responsibility with the public.

The errors of enumerators are likely to vary, first, with the character of the men and this probably with the method of their appointment, secondly, with the lucidity and detail of their instructions and the means taken to secure a mastery of those instructions before the field work begins, thirdly, with the care and success with which the field work is superintended, and fourthly, with the method of their payment.

The errors of the central office are either clerical mistakes in copying or tabulating results, a large proportion of which are discovered and corrected in the progress of the work, or errors of analysis and interpretation of results. The former class are usually beyond detection by the private student, but fortunately are seldom of material importance; the latter are sometimes serious and misleading.

Prior to the commencement of work on the Eleventh Census the attitude of the public towards such statistical work was probably more favorable than ever before. The rapid dissemination of elementary education had been helpful. Statistical arguments and with them a realization of the importance of statistics had become more common. More states than previously had taken censuses of their own and so educated the public to expect such questions. The appointment of the superin-

tendent of the Eleventh Census, however, was not received with as general and deep popular satisfaction as that of his predecessor, General Francis A. Walker. Upon the results of a census depend the distribution of seats and possibly the balance of power in the House of Representatives. A department which has to furnish the facts upon which the decision of these questions is based should be as free from suspicion of partizan bias as the Supreme Court, and the work of a census officer is probably more completely separable from politics than is that of a judge. However high the qualifications of the superintendent of the Eleventh Census for his position may have been, he had not at the time of his appointment earned a national reputation as an impartial statistician at all comparable with that of his predecessor. He was known to have done much work for leading newspapers of his political party. I cannot but think, therefore, that the appointment did not deepen the popular faith that the approaching census would be accurate and impartial, and such faith is almost an indispensable prerequisite of thoroughly satisfactory work. Further doubt and opposition were aroused in certain quarters by the failure to employ competitive examinations in selecting subordinate employees. Whether the responsibility rested upon Congress which passed the law or upon some one or more of the executive officers who carried it into effect is immaterial to my contention. The claim that the methods employed in the Tenth Census were being followed did not disarm the criticism; the civil service law had been passed

in the interim and public opinion had altered. Evidence was offered in the press that enumerators were appointed at the suggestion of party leaders.¹ The supervisor of the New York city district was charged with the appointment of about eight hundred enumerators. A prominent metropolitan paper printed a circular letter alleged to have been sent by him to local Republican politicians and reading as follows: "Dear Sir: Will you please forward to this office the list of applicants that the Republican organization of your district desires to have named as census enumerators?"² Statements were published that some enumerators were unable to read or write,³ that others had their photographs in the Rogues' Gallery.⁴ The circulation of such assertions whether true or false could not but impair the popular confidence in the census.

Evidence of careful supervision of the work, however, is offered by the instructions sent out to the forty thousand enumerators connected with the census. They fill a pamphlet of 46 pages, are more than twice the length of the instructions issued for the preceding census and show in many ways an advance in lucidity and detail. No light has been found upon the question whether the enumerators were compelled to master these instructions before entering upon their duties or whether their reports day by day were carefully scrutinized to insure conform-

¹ Civil Service Record, April, 1891, p. 102.

² Nation, 51 : 224.

³ Civil Service Record, August, 1890, p. 12.

⁴ Letter of W. D. Foulke, N. Y. Daily Times, Nov. 15, 1890, p. 5.

ity. They were paid usually at the rate of two cents for each name returned, but in sparsely settled districts somewhat more.¹ This method of payment, while tempting the enumerator to include all doubtful names even at the risk of double enumeration, also invites him to pass by those whom it is more than two cents' worth of trouble to reach.

The methods of impeaching a census may be grouped into four classes :

1. It may be proved that faults existed either in the census law or in the organization or administration of the working force and that their inevitable or natural result would be serious inaccuracies of enumeration.
2. Inferences logically drawn from different parts of a census may prove to be irreconcilable.
3. The results may be compared with those obtained by another count, which was taken at about the same time and proved to be more accurate.
4. The results may be compared with those of a series of enumerations before and after the one in question, on the assumption that a general uniformity in the rate of change should appear and that any wide and unexplained variation from it is evidence of error.

These lines of attack find partial illustration in the arguments by which all critics have been convinced that serious errors crept into the Ninth Census and that the Tenth was more correct than any previous one. After years of attempted administration of the law of 1850, under which the Ninth Census was taken, General Walker pointed out its faults. It laid the supervision of the

¹ Census Law, § 11.

enumeration in each district upon an officer already burdened with other duties and gave the census office no control over him. Under such circumstances, the office disclaimed responsibility for the results reported.¹ And again, when the results of the census of 1880 in parts of the south indicated an incredible increase of population in the preceding decade, a recount was ordered in some localities with results uniformly confirming the later and discrediting the earlier enumeration.

In all these four ways critics have sought to impeach the Eleventh Census. A brief summary of the conclusions to which I have been brought with my reasons for holding them is here presented.

The law under which the last census was taken is substantially a re-enactment of the law of 1879. Of the earlier law General Walker said in his official report, written after he had been administering its provisions for six months: "The legislation of the last Congress on the subject of the census was wise and salutary. Not a single fundamental defect in the scheme of enumeration has appeared."² The superintendent of the Eleventh Census called to his aid many of the most valued assistants at the previous count. He says: "Five-sixths of all the experts and chiefs had experience in the Tenth Census,"³ and that sixteen of the twenty-five divisions were in charge of the same men who were over them in 1880.⁴

¹ Report of Superintendent of Census. Tenth Census, Compendium, Part I, p. ix.

² *Ibid.*, p. xxxiv.

³ Eleventh Census, Compendium, Part I, p. xxxii.

⁴ R. P. Porter, *Partisanship and the Census*. *North American Rev.*, 151:662.

Over against these facts should be set two charges which, in my opinion, have not been adequately met, first, that the career and published work of Mr. Porter were not those of an independent and judicial statistician and, secondly, that in the appointment of enumerators and other subordinates, there is reason to believe that the letter and spirit of the census law requiring enumerators to be "selected solely with reference to fitness and without reference to their political party affiliations,"¹ were less strictly interpreted and enforced in 1890 than in 1880. In addition to the evidence already cited upon this point, I am allowed to quote the following from a personal letter written to me in 1896 by Dr. John Shaw Billings, who was in charge of the division of Vital Statistics at the Eleventh Census :

"The whole of my work in the census has been done in the face of great obstacles, owing to repeated changes of clerks for political reasons, etc., and I am tired of struggling with the most unpropitious circumstances which have surrounded the work." It seems probable that the law under which the Eleventh Census was taken was better than any prior to 1879, but that its administration was somewhat inferior to that of the Tenth Census.

Arguments based upon the apparent inconsistency of different parts of the census are best presented in connection with the topics to which they relate and their consideration is, therefore, postponed.

Recounts of the entire population occurred, so far as

¹ Laws of 1879 and 1889, § 5.

I have ascertained, in the case of four cities, St. Paul and Minneapolis, Minn., Helena, Mont., and Portland, Ore. In each case important errors were discovered either before or during the recount. Partial recounts were ordered in other places with results confirming the figures originally given to the public.

The fourth and most important method of attack is not yet fully possible. It was not until the results of the census of 1880 were published and confirmed that those of the Ninth Census were generally discredited, and the best test of the correctness of the Eleventh Census will be the degree to which it conforms to the Twelfth and subsequent counts.

The recent appearance of the results of many state censuses, however, permits a partial application of this line of criticism. The method employed in such a test is to assume that the population of a state was correctly enumerated at the censuses next before and after that of 1890, and from these two fixed points to compute what it was at that date. Wide and frequent variations between such estimates and the results of the Eleventh Census would be suspicious. General agreement between them would be strong proof of the accuracy of the disputed facts. Close and constant correspondence is not to be anticipated.

In order to apply this test, I have sent a circular letter to the secretary of state of each state in which, either from the recent report of the Commissioner of Labor upon a plan for a permanent census bureau¹, or from the World

¹ Fifty-fourth Congress, Second Session, Senate Document, No. 5, p. 11, (December, 1896).

Almanac for 1897,¹ I had reason to believe that an enumeration had been made since 1890. The letter asked for the year and month of the state census and for the total population enumerated, but in many replies only the year was stated. In those cases I have assumed that the census was taken in June. From the answers the table on the following page has been compiled:²

From the figures thus brought together it is possible to compute the population of each state at the date of the Eleventh Census, June, 1890, and to compare the result with the figures in dispute. For this purpose two methods are in use, the arithmetical and the geometrical, the former assuming that a given population increases by a constant number in a unit of time like a year, and the latter assuming that the population increases by a

¹ Page 378.

²The Indiana secretary of state wrote: "No census of the state of Indiana has been made since that of 1890, except that made in April of 1895, giving the voting population of the state." For this reason Indiana, although included in the Commissioner of Labor's list, has been omitted. Oklahoma and South Dakota had no census prior to 1890. No reply was received from the secretary of state of Tennessee. Kansas is omitted because of the confessed incompleteness of the enumeration in 1895. The Oregon census of 1885 has been disregarded because the slight increase it showed over the census of 1880 arouses suspicion that like the last census of Kansas, it was incomplete. The bitter controversy over the accuracy of the Federal enumeration of New York city and Brooklyn in 1890 and the fact that the state enumeration of 1892 was superintended in those cities by persons presumably interested in proving that the national count was seriously deficient have induced me to make a comparison merely for the rest of the state, with reference to which no charges of serious error have been made. The police census of New York city in 1895, however, makes possible an estimate of its population in 1890 by comparing this census with that of 1880, and hence it has been included.

TABLE IV.

POPULATION OF STATES BY CENSUSES TAKEN SINCE 1890.

STATES.	Date of Census.	Population.	Date of Census.	Population.
Florida	1885	342,617 ¹	1895	464,639 ²
Iowa	1885	1,753,98. ³	1895	2,058,069 ³
Massachusetts . .	May, 1885	1,942,141 ⁴	May, 1895	2,500,183 ⁴
Michigan	June, 1884	1,853,658 ⁵	June, 1894	2,241,641 ⁵
Minnesota	June, 1885	1,117,798 ⁶	June, 1895	1,574,619 ⁶
New Jersey	1885	1,278,033 ⁷	1895	1,673,106 ⁷
New York ⁸	June, 1880	3,277,077 ⁹	Feb., 1892	3,716,329 ¹⁰
Oregon	June, 1880	174,768 ⁹	1895	362,513 ¹¹
Rhode Island . . .	June, 1885	304,284 ¹²	June, 1895	384,758 ²
Utah	June, 1880	143,963 ⁹	Feb., 1895	247,324 ¹³
Wisconsin	1885	1,563,423 ¹⁴	1895	1,937,915 ²
New York City . .	June, 1880	1,206,299 ⁹	Apr., 1895	1,851,060 ¹⁵

constant per cent. The difference is like that between simple and compound interest. Each involves an artificial simplification of a complex problem and each applied generally and to long periods of time results in absurdities. No population increases in either way. Non-progressive communities usually do not increase at all and among the most developed communities or

¹ American Almanac, 1889, p. 168.
² Personal letter from the secretary of state.
³ Census of Iowa, 1895, p. 259.
⁴ Census of Massachusetts, 1895, Volume I, Part I, p. 23.
⁵ Census of Michigan, 1894, Volume I, p. xli.
⁶ Census of Minnesota, 1895, p. 65.
⁷ Census of New Jersey, 1895, pp. 34, f.
⁸ The State excluding New York city and Brooklyn.
⁹ Eleventh Census, Compendium, Part I, pp. 32, f.
¹⁰ Census of New York, 1892, pp. 4, f.
¹¹ Census of Oregon, 1895, p. 11.
¹² Census of Rhode Island, 1885, p. 89.
¹³ Census of Utah, 1895, p. 17.
¹⁴ Census of Wisconsin, 1885, p. 38.
¹⁵ Census of New York City, 1895, p. 7.

classes the desire for other elements of wellbeing than children may bring mankind again to a stationary condition. Between these limits population ordinarily increases with the increase of food, but less rapidly. Mr. Farr seems to have assumed that because Malthus asserted that population tended to increase at a geometrical rate, therefore the formula by which population should be estimated was that of compound interest.¹ The assumption was better than the reason on which it was based. The true justification for the Registrar-General's method of estimating population is not Malthus's theory of a tendency, translated as he never translated it into a law of population, but the fact that the population of England computed by this method has been nearer to the results of a careful census than that resulting from a use of the arithmetical method or any other available. The same method is to be extended to other countries only after testing the results of the two and showing its greater accuracy. There are many considerations pointing to the conclusion that the rate of increase of population in the United States now is less than it has been in the past, and that it will be less in the future than it is now. For countries with a slowly decreasing rate of increase, the application of the geometrical method to the determination of the population between two censuses will give erroneously small results, and under such circumstances the arithmetical method may be the better way to approximate the facts. It has been shown that this method would have been somewhat more accurate for

¹ Farr, *Vital Statistics*, p. 19.

Massachusetts since 1850¹ and for Michigan in recent years,² and I am inclined to believe that it corresponds more closely than the other to the present conditions in most of our states. On the other hand the annual number of immigrants between 1890 and 1895 was slightly greater than the number between 1885 and 1890³ and the excess of births over deaths in Massachusetts and Rhode Island between 1890 and 1894 was larger both absolutely and relatively to the population than between 1885 and 1890.⁴ On the whole I slightly prefer the arithmetical method for the United States at present, but in the table on the following page both have been applied.

The censuses and estimates in these tables apply to over twenty-seven per cent. of the total population of the country and the total estimated by one method is within one-half of one per cent. and by the other within one and a half per cent. of the result of the census. But it might be fairer to exclude New York city, where the census of 1890 may have been exceptionally defective and where the difficulties of an accurate count are unparalleled. If this be done the deviation from the esti-

¹ F. S. Crum, *The Marriage Rate in Massachusetts*, Pub. Am. Stat. Ass'n., 4 : 325, (Dec., 1895).

² Michigan Registration Report, 1893, pp. 6-10, and C. L. Wilbur, *Note on Methods of Estimating Population*, Pub. Am. Stat. Ass'n., 5 : 83-86, June, 1896.

³ *World Almanac*, 1897, p. 149.

⁴ 27 Report of Mass. State Board of Health, 1895, p. 1 ; 17 Report of R.I. Board of Health, 1894, p. 111. I believe these are the two states whose birth and death rates are most correct.

TABLE V.
COMPARISON BETWEEN RESULTS OF ELEVENTH CENSUS AND ESTIMATES.

STATES.	Population, June, 1890.			Per cent. of variation from enumerated population of that estimated by	
	Estimated by arithmetical method.	Enumerated.	Estimated by geometrical method.	Arithmetical method	Geometrical method
Florida	403,628	391,422	398,440 ¹	+ 3.12	+ 1.92
Iowa	1,906,024	1,911,896	1,882,200	- .31	- 1.55
Massachusetts	2,225,812	2,238,943	2,209,700	- .59	- 1.31
Michigan	2,086,448	2,093,889	2,076,700	- .36	- .82
Minnesota	1,346,208	1,301,826	1,326,600	+ 3.41	+ 1.90
New Jersey	1,475,569	1,444,933	1,447,200	+ 2.12	+ .16
New York ²	3,653,577	3,644,005	3,649,900	+ .26	+ .16
New York city	1,640,969	1,515,301	1,610,000	+ 8.29	+ 6.25
Oregon	299,931	313,767	284,320	- 4.41	- 9.83
Rhode Island	345,521	345,506	342,120	+ .00	- .98
Utah	214,436	207,905	207,990	+ 3.14	+ .05
Wisconsin	1,750,669	1,686,880	1,740,600	+ 3.78	+ 3.18
Total	17,348,792	17,096,273	17,176,270	+ 1.48	+ .47

mates by either method would be well within one per cent. In other words, assuming (1) that the eleven state censuses were all accurate; (2) that the average of these results may be extended to the remaining three-fourths of the population of the United States, and (3) that the population of the whole country has been growing by a constant amount annually, its true population in June, 1890, was about 63,135,000, and the omissions in the

¹ It will be noticed that the numbers in this column are only approximations. They have been computed with the aid of Fuller's spiral slide rule. As the error involved will not affect the per cents in the last column it seemed unnecessary to spend the additional time necessary for greater accuracy.

² Excluding New York city and Brooklyn.

Eleventh Census were rather over half a million, or slightly more than four-fifths of one per cent. On the other hand, if, in accordance with the weight of authority, the assumption that the population has been growing at a constant rate be preferred, then the true population of the United States in June, 1890, was about 62,560,000, and the Eleventh Census reported about 60,000 more people than there were in the country, an error of about one-tenth of one per cent. The only obvious escape from the conclusion is to deny the general accuracy or the typical character of the state censuses, and I see no reason for either. This constitutes a strong argument in favor of the substantial accuracy of the Eleventh Census. Until it is answered or more evidence is presented, the results of that count, it seems to me, must be accepted as more accurate than any estimate which can now be substituted for them. A reader loath to admit a conclusion which has been so often disputed or denied, may attach weight to the opinion of a disinterested expert thoroughly competent to judge. I quote by permission from a letter written to me in July, 1897, by the present head of the Eleventh Census, Carroll D. Wright, Commissioner of Labor. He says: "I think that the Eleventh Census came within less than one per cent. of the true enumeration of the inhabitants. While there was a slight shortage in some cases, this was doubtless in part offset by an unavoidable duplication of names in other parts."

My own opinion has been considerably modified by the study, the conclusions of which have been presented,

and I am now convinced that the count is to be accepted. Whatever decision may be reached on the complicated question, critics will probably agree that if the accuracy of the census is to be upheld, it must be on different grounds from the curiously improbable ones stated in the census volumes themselves.¹ They argue that the usual estimate of half to three-fourths of a million for the omissions of the census of 1870 is altogether too small, and that the true population at that time may be better approximated by assuming that "the rate of increase in the southern states between 1860 and 1870 and between 1870 and 1880 was the same." The tacit assumption that the civil war had no perceptible effect upon the decennial increase of population as compared with that of the following decade, is so violent as to arouse the suspicion that the writer was hard pressed for arguments, and the suspicion is confirmed on noticing that the hypothesis is twice denied within the following five pages, but after the necessities of the argument are removed. This may have contributed more than it should to undermine my confidence in a work which appealed to such support. For the foregoing reasons, it is my belief that the Eleventh Census is well within one per cent. of the truth in its statement of the total population of the United States, and that there is little likelihood that now or in the future estimates of greater accuracy can be made.

¹ Eleventh Census. Population, Part I, pp. xi, xii. Compendium, Part I, pp. xxxv-xxxvii.

Statistics has not yet obtained a definite answer to the question, How many people are there on the earth's surface? But much progress has been made in the present century towards its solution. At its beginning the highest careful estimate was probably that of Suessmilch, who had computed it in 1761, as rather more than a billion.¹ In the dearth of better information, he was compelled to guess at the population of Asia by assuming that on the average it was as thickly settled as Europe, and being five times as large, had accordingly five times as many inhabitants.² At the present time, the best authorities concur in putting the population of the earth nearly fifty per cent. higher than Suessmilch did.

ESTIMATED POPULATION OF THE EARTH.

AUTHORITY.	Date.	Estimate.
Levasseur ³	1886	1,483,000,000
Ravenstein ³	1890	1,467,920,000
Wagner and Supan ³	1891	1,480,000,000
Juraschek ³	1893	1,485,763,000

The results of careful and long continued efforts to determine the population of the earth are found in *Die Bevölkerung der Erde*, and at almost every issue of this work the figure stated as the conclusion of the authors' studies has been an increase on their preceding

¹ His table gives 1,080 million and is followed by the statement, "The entire sum of all persons on the earth's surface accordingly is between 1000 and 1100 million." *Die Göttliche Ordnung*, ed. 1761, vol. 2, p. 234.

² *Ibid.*, p. 215.

³ *Op. cit.*

estimates. This will appear from the following summary of their figures in chronological order.

WORLD'S POPULATION IN MILLIONS ACCORDING TO SUCCESSIVE
ISSUES OF DIE BEVÖLKERUNG DER ERDE.

Date.	Estimate.
1866	1350
1872	1377
1874	1391
1875	1397
1876	1424
1878	1439
1880	1456
1882	1434
1891	1480

The causes of the almost uninterrupted increase in the size of the estimates are an actual increase in the population and the extension of the statistical method. Thus the number of persons in 1880 who had been either counted, or, as in Russia, ascertained by many years of registration, was 626 million.¹ The population of the same countries in 1891 was 737 million, an increase of nearly eighteen per cent. Forty-one million of this was found in Europe and over twelve in the United States, where it was due to actual increase. Forty-one million was found in British India, where a considerable part may have been due to the improved accuracy of the censuses of 1881 and 1891 over the first Indian census, that of 1871. Since 1880 censuses or careful registrations have been had for the first time in some of the smaller states of southeastern Europe, in most of the native states of India, in Japan and other localities. The combined population of these regions was estimated in 1880 as 85 million; the application of the statistical method showed it to be 99 million. This method has now been applied

¹ Die Bevölkerung der Erde, 1891, p. vi.

to 836 million people, one-third more than in 1880, and about five-ninths of the estimated population of the earth, but included in this total are the 113 million inhabitants of the Russian Empire, where the first census is now (1897) in progress. A partial offset to this increase in the population of well-governed communities is found in reductions of the estimates for Africa by 38 million and for Asia by 8 million. The greatest open problem is that of the population of China, where two imperfect enumerations have been made during the century, that of 1812 showing 362 million and that of 1842 showing 413 million. The present tendency of critics seems to be in the direction of discarding entirely the results of the later enumeration and assuming that the population has remained stationary or decreased since 1812, but current estimates still differ by nearly 200 million.¹

It is well-nigh impossible carefully to compare either the area or the population of the continents because there is no concensus regarding their boundaries or the treatment of adjoining islands or polar lands. Hence in both cases the appropriate large unit is the great power, since every nation defines and if possible compels the acceptance of its boundaries. From the standpoint of population the great power may perhaps be defined as one having a population of 35 million or more. In this sense there are probably ten great powers and the number of their inhabitants including those in all dependencies is indicated in the following table :

¹Op. cit., p. 100.

TABLE VI.

POPULATION OF THE MOST POPULOUS COUNTRIES ACCORDING TO VARIOUS AUTHORITIES.

COUNTRIES.	Geographisch-statistische Tabellen, 1893.	Almanach de Gotha, 1897.	Statesman's Year-Book, 1897.
China	359,750,000	357,250,000	402,680,000
British Empire . . .	352,374,409	360,800,000	383,488,469
Russian Empire . . .	116,812,731	121,405,828	129,545,000
France	76,594,435	79,153,192	70,467,775
United States	62,979,766	62,982,244	62,979,766
German Empire . . .	55,658,794	59,353,894	62,879,901
Austria-Hungary . . .	43,233,073	41,384,956	41,358,886
Japan	40,453,461	41,810,202	41,813,215
Netherlands	36,910,345	39,252,151	38,859,451
Ottoman Empire . . .	21,183,299	36,900,000	39,212,000
Total	1,165,950,313	1,161,040,317	1,273,284,463

About four-fifths of the inhabitants of the earth are under the sway of some one of these ten great powers. Seven are European in origin and dominant civilization and Christian in religion, Japan is seeking to assimilate or adapt the culture of Europe, while the two other great powers, China and Turkey, are probably stationary or decreasing in population and growing relatively if not absolutely weaker. Among these powers the United States occupies the fifth place and includes about one twenty-fifth of the population of the earth.

It would lead one too far afield to examine the reasons for the differences in the preceding table, but as we are especially concerned with the United States, the figures for their population may be scrutinized in detail. Two of the authorities agree but the third differs by nearly 2,500. The World Almanac for 1897 gives the total population of the United States in 1890 as 62,831,900

[p. 373]. These differences in secondary authorities slight as they are must have some cause. All agree in the basis of the figures, 62,622,250 as the number of residents of the forty-nine states of the Union enumerated in the general count. To this number must be added the population of Alaska, of Indian territory, and of the Indian reservations in other parts of the country. The World Almanac falls into error by ignoring the last of these three additions. But the population of Alaska is given in the World Almanac and at one place in the Tribune Almanac for the current year as 30,329, in the Almanach de Gotha as 31,795 and in the Statesman's Year-Book as 32,052. The first of these numbers is derived from Census Bulletin 30, February 11, 1891, (Alaska, Statistics of Population), which contains a summary of the population as far as then received, 21,929, and adds that 8,400 more will probably come in from remote districts. The second number is taken from Census Bulletin 150, November 28, 1891, (Population of Alaska, Official Count.) The third is derived from the census volume on Alaska published at Washington in 1893. Thus one provisional and two final official statements of the population of Alaska were issued by the Census Office, all different, and apparently no attempt was made to explain their conflict. It is unfortunate to issue provisional and incorrect statements which thus give rise to perpetuated blunders difficult to trace and correct, and in the present case it can scarcely be argued in defense that the people at large or important special interests were waiting impatiently

to learn the population of Alaska. The three secondary authorities differ also in their statements of the population of Indian territory, but the source used by the American and German compilations remains undetected. In this case as in the preceding the English manual is correct.

The word population is used in the census volumes in three senses : 1. The constitutional population, which is the basis for the apportionment of members of the House of Representatives. It excludes all residents of territories, the District of Columbia or Indian reservations.¹ 2. The general population, which includes, in addition to the constitutional population, the residents of the District of Columbia and those living off the Indian reservations in all territories except Indian territory and Alaska. 3. The total population, which includes, in addition to the general population, all residents of Indian reservations, Indian territory and Alaska. Of these three meanings, the most commonly employed in the census volumes is the second. For scientific purposes the third is the important one, and hence it is satisfactory to note the suggestion that "it may be advisable hereafter to include in the general population all human beings within the limits of the country whether Indians in tribal relations or otherwise."² The constitutional population of the United States June 1, 1890, was 61,908,906 ; the general population was 62,622,250 ; the total population was 62,979,766.

¹ This meaning is very uncommon, but occurs in *Compendium*, Part I, p. v.

² Eleventh Census, Population, Part 1, p. c.

While for the country as a whole, the census gives the total population, for the several states it gives only the general population. To find their total population the results of the special Indian census must be added.¹ In this way the following table has been prepared. The states are arranged in the order of rank and the proportion that the population of each state makes of the entire population of the country has also been computed and included.

TABLE VII.

TOTAL POPULATION OF EACH STATE AND PERCENTAGE OF COUNTRY.

STATES.	Population.	Per-centage.	STATES.	Population.	Per-centage.
New York . . .	6,003,174	9.532	West Virginia .	762,794	1.212
Pennsylvania .	5,258,113	8.349	Connecticut . .	746,258	1.185
Illinois	3,826,352	6.076	Maine	661,086	1.050
Ohio	3,672,329	5.831	Colorado	413,249	.656
Missouri	2,679,185	4.254	Florida	391,422	.621
Massachusetts .	2,238,947	3.555	New Hampshire	376,530	.598
Texas	2,235,527	3.550	Washington . .	357,232	.567
Indiana	2,192,404	3.481	South Dakota .	348,600	.554
Michigan	2,093,890	3.325	Rhode Island .	345,506	.549
Iowa	1,912,297	3.037	Vermont	332,422	.528
Kentucky	1,858,635	2.952	Oregon	317,704	.505
Georgia	1,837,353	2.917	Dist. of Columbia	230,392	.366
Tennessee . . .	1,767,518	2.807	Utah	210,779	.335
Wisconsin	1,693,330	2.689	North Dakota .	190,983	.303
Virginia	1,655,980	2.630	Indian Territory	180,182	.286
North Carolina	1,617,949	2.569	Delaware	168,493	.268
Alabama	1,513,401	2.403	New Mexico . .	160,282	.255
New Jersey . . .	1,444,933	2.294	Montana	142,924	.227
Kansas	1,428,108	2.267	Idaho	88,548	.141
Minnesota . . .	1,310,283	2.080	Arizona	88,243	.140
Mississippi . . .	1,289,600	2.048	Oklahoma	78,475	.125
California	1,213,398	1.927	Wyoming	62,555	.099
South Carolina	1,151,149	1.828	Nevada	47,355	.075
Arkansas	1,128,211	1.791	Alaska	32,052	.051
Louisiana	1,118,588	1.776			
Nebraska	1,062,656	1.687	Total	62,979,766	100.006
Maryland	1,042,390	1.655			

¹To be found in Eleventh Census, Indians, p. 81.

The table shows that the eight most populous divisions of the country form a belt stretching with but one break, across the country from Massachusetts bay to the Rio Grande. This belt, with Michigan, includes every state with over two million inhabitants, and if Iowa also be added to the list, these ten populous states have over one half of the population of the country. The eight states with least population include, besides Alaska, seven lying in the form of a letter C almost enclosing Colorado and Utah and nowhere touching the coast. They have altogether 700,434 inhabitants, about the same as Maine or Connecticut, and rather more than one per cent. of the population of the entire country. The area they occupy is one and a quarter million (1,245,100) square miles, over two-fifths of the country, or far more than the total area east of the Mississippi. It may also be noticed that only two of the fifty-one states decreased in population in the last decade, and that these were the least populous ones, Nevada and Alaska.

The total population of the counties cannot be known. The results of the special Indian census are given only by states. Hence only the general population of the counties is ascertainable, but as in most of them there are no Indian reservations this fact especially in the eastern states is of little moment. The enumerated population of a county ranges from 3 (in Mackenzie county, North Dakota and Loving county, Texas) to over one and a half million (New York county) and the average population of the 2784 counties outside Indian territory is about 22,500 (22,494).

There are 24 counties, including under that name the District of Columbia, each of which has a population of over two hundred thousand, and 34 each of which has a population of between one and two hundred thousand. Of the former group only one, San Francisco, lies west of the west bank of the Mississippi and only one other, Orleans, lies south of the line of the Potomac and the Ohio. Three-fourths of them touch either the Atlantic or one of the Great Lakes. The populous counties of the country are massed between the Atlantic ocean and the Great Lakes, and the Mississippi, Ohio and Potomac rivers. Of the 58 counties with more than 100,000 inhabitants 49 lie in this region.

But such comparisons as have been implied between the population of different countries, states, or counties may suggest the danger of disregarding the wide differences of area involved. The Netherlands including its East Indian possessions may have about the same population as the Ottoman Empire, or Massachusetts as Texas, or New York as Chicago, but in proportion to the area occupied the two members of each pair differ widely. To avoid the errors likely to arise from overlooking the differences of area, the ratio of population to area or the density of population must be ascertained. Discussion of this subject is reserved for a subsequent study.

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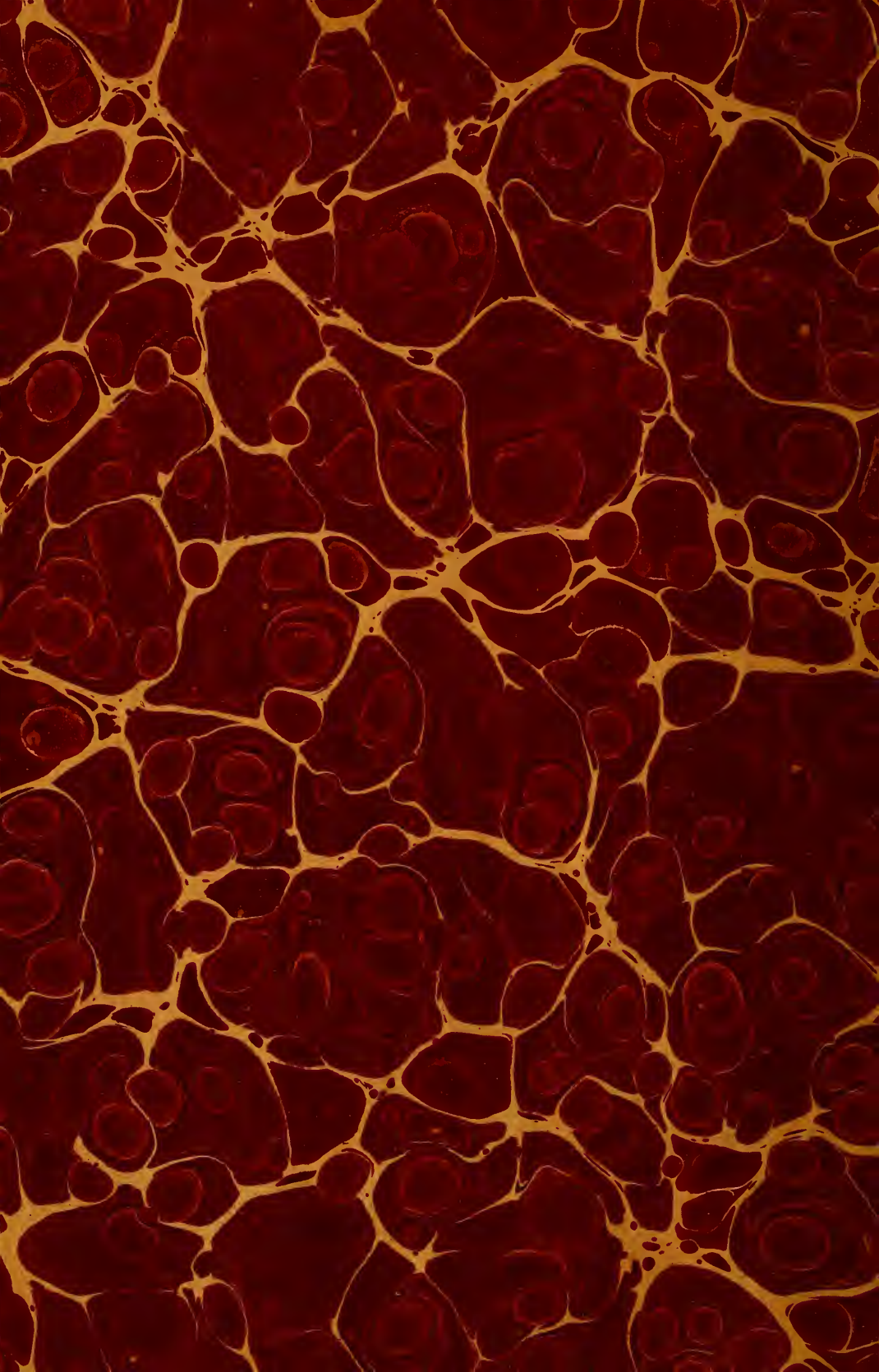
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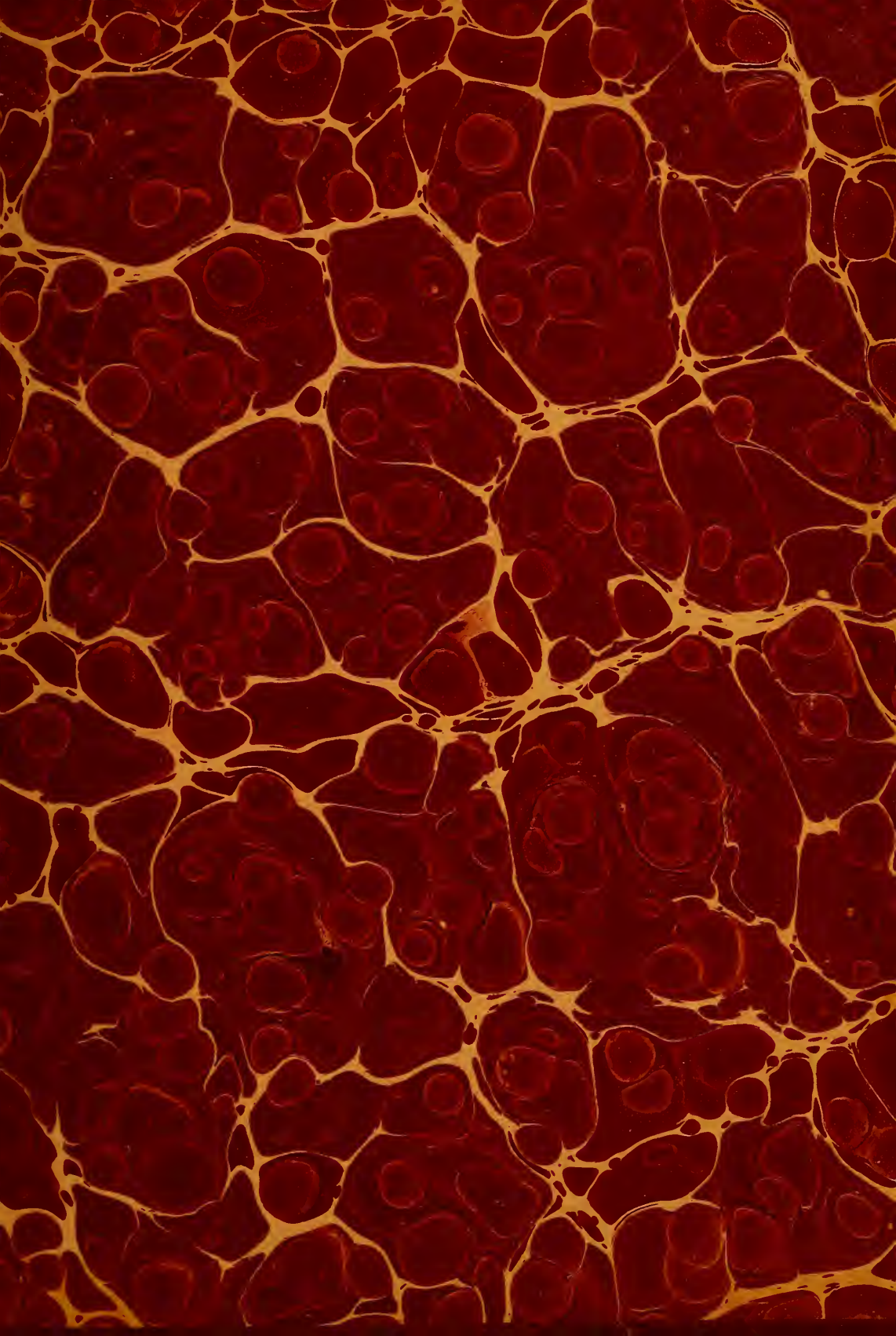
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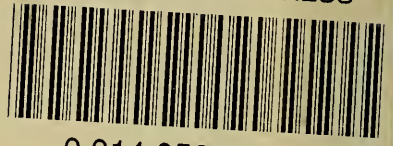
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